

Before Kane Williamson hit this pull shot, the ball was travelling down the pitch toward him at a speed of around 140kph.  
  
After he hits it, it is speeding off to the boundary at a completely different angle.  
  
Assume that the motion is completely horizontal. The shot might look something like this:

The arrows represent the initial and final velocities of the ball. Say the initial magnitude is 142kph and the final is 130kph. Make the angle behind square (the dotted line) 22°  
  
Answer on refill:  
  
1. Calculate the change in momentum (Δp) of the cricket ball. The mass of a cricket ball is 163g.

2. The ball changed its velocity (speed **and** direction) because of the force of Williamson’s bat. Using the definition of acceleration (Δv/Δt), and Newton’s second law, derive an equation linking Force to change in momentum.

3. Estimate how long the ball was in contact with the bat and hence work out the magnitude of the force of bat on ball. Note: assume this force is constant.

4. In reality, the ball would have been travelling upwards when it reached him. Use conservation of momentum to explain why a completely crossbat (horizontal) shot may have resulted in Williamson being caught on the boundary, and why players often “roll their wrist” downward when playing a pull shot.